

Teacher Management Strategies in Technology-Integrated IPAS Learning: A Case Study of Two Elementary Schools

Ana Nurjanah*, S Sobari

Nusantara Islamic University, Bandung, Indonesia

*Corresponding Email: ananurjanah@uninus.ac.id

Abstract. The rapid development of information and communication technology presents both opportunities and challenges for elementary education, particularly in enhancing students' literacy and learning engagement. This study aims to analyze teacher management strategies in integrating technology into science and social studies (IPAS) learning at SDN Giriwinaya and SDN Sukabakti. The research employed a qualitative approach with a descriptive case study design. Data were collected through in-depth interviews, classroom observations, and document analysis involving IPAS teachers, school principals, students, and school committee members. Data were analyzed using the interactive model of Miles, Huberman, and Saldaña, while data trustworthiness was ensured through triangulation, member checking, and audit trails. The findings reveal that teacher management strategies in technology integration are implemented through four interconnected stages: planning, organizing, implementation, and evaluation. Teachers design TPACK-based lesson plans, organize technological and human resources collaboratively, implement interactive digital learning activities, and conduct evaluations using digital assessments and reflective practices. These strategies contribute to increased student engagement, improved understanding of IPAS concepts, and the development of digital literacy. The study concludes that teachers' managerial roles are critical in ensuring effective and sustainable technology integration in elementary education. The findings offer theoretical contributions to educational management and practical implications for teachers, school leaders, and policymakers in developing context-sensitive technology-based learning strategies.

Keywords: Digital Literacy, Elementary School, Teacher Management Strategy, Technology Integration, IPAS learning

1 Introduction

The rapid advancement of information and communication technology (ICT) has fundamentally transformed educational practices worldwide. In the context of 21st-century education [1]–[3], elementary schools are no longer expected to merely transmit basic knowledge but are also required to foster students' critical thinking, problem-

solving skills, and digital literacy [4], [5]. Technology integration in learning has therefore become an unavoidable necessity, particularly in science and social studies (IPAS), which demand contextual understanding and inquiry-based learning [6]–[8].

Teachers play a pivotal role in responding to these challenges, as they are the main actors responsible for designing, implementing, and evaluating meaningful learning experiences [9]. Beyond their instructional role, teachers are increasingly required to function as learning managers who strategically organize resources, learning media, and classroom interactions to support effective technology integration. Effective teacher management strategies are essential to ensure that technology use goes beyond mere substitution and contributes to improved learning quality and student engagement [10].

Schools, as formal educational institutions, bear a critical responsibility for ensuring that learning processes align with technological and pedagogical developments. However, empirical conditions in many elementary schools indicate that technology integration remains suboptimal. Reports from educational assessments reveal that students' literacy levels, particularly digital literacy, are still relatively low. This condition is also evident in SDN Giriwinaya and SDN Sukabakti, where limitations in infrastructure, teacher technological competence, and systematic management strategies pose significant challenges to the effective integration of technology in IPAS learning.

Although technology integration in education has been widely promoted, its implementation at the elementary school level often encounters structural and managerial barriers. Teachers frequently experience difficulties related to limited access to digital tools, insufficient training, and the absence of comprehensive planning frameworks. As a result, a gap emerges between the ideal expectations of technology-based learning and the realities of classroom practice. This gap highlights the importance of examining how teachers manage the planning, organizing, implementation, and evaluation of technology-integrated learning in a systematic manner.

Previous studies have emphasized the importance of teacher readiness and competence in technology integration. Sudargini [11] demonstrated that teachers' technological competence significantly influences student learning outcomes, while Srtemberger identified teacher attitudes and preparedness as key determinants of successful digital learning [12]. Furthermore, Utami argued that teachers require structured management strategies to adapt to the demands of digital-era education [13]. However, most existing studies tend to focus on individual teacher competencies rather than examining teacher management strategies through the lens of educational management functions.

The novelty of this study lies in its emphasis on teachers as learning managers who strategically integrate technology into IPAS instruction using a management framework. This research positions technology integration not merely as a technical skill but as a managerial practice involving systematic planning, organization of resources, instructional implementation, and continuous evaluation. By adopting the Technological Pedagogical Content Knowledge (TPACK) framework, this study explores how teachers align pedagogical approaches, content knowledge, and technological tools to create interactive and meaningful learning experiences in elementary schools [14].

Given the qualitative nature of this study, no explicit hypotheses are formulated. Nevertheless, the study is implicitly grounded in the assumption that well-structured

teacher management strategies in integrating technology contribute positively to the quality of IPAS learning and students' digital literacy development. Therefore, this research seeks to provide empirical evidence regarding the relationship between teacher management strategies and the effectiveness of technology-integrated learning at the elementary school level.

The purpose of this study is to analyze teacher management strategies in integrating technology into IPAS learning at SDN Giriwinaya and SDN Sukabakti, focusing on four key management functions: planning, organizing, implementing, and evaluating. The findings are expected to contribute theoretically to the field of educational management and practically to teachers, school leaders, and policymakers in developing adaptive and effective technology-based learning strategies in elementary education.

2 Method

This study employed a qualitative approach with a descriptive case study design. The qualitative approach was selected to enable an in-depth understanding of complex educational phenomena within their natural contexts, particularly regarding how teachers manage the integration of technology in IPAS learning. Qualitative inquiry emphasizes meaning, process, and contextual interpretation rather than numerical measurement, making it suitable for exploring managerial practices and lived experiences of teachers [15], [16]. The case study design was chosen because it allows for a comprehensive exploration of a bounded system in real-life settings, especially when the boundaries between the phenomenon and its context are not clearly evident [17], [18].

The research was conducted at two public elementary schools, namely SDN Giriwinaya and SDN Sukabakti, located in Warungkondang District, Cianjur Regency. These schools were selected purposively based on their relevance to the research objectives, particularly their ongoing efforts to integrate technology into IPAS learning despite infrastructural and managerial limitations. The primary research participants were IPAS teachers from both schools, as they are directly involved in planning, organizing, implementing, and evaluating technology-integrated instruction. Additional informants included school principals, students, and school committee representatives to provide richer contextual insights and support data triangulation.

Data were collected using methodological triangulation, consisting of in-depth semi-structured interviews, classroom observations, and document analysis. Interviews were conducted to capture participants' perspectives, experiences, and strategies related to teacher management and technology integration. Classroom observations were used to examine real-time instructional practices, teacher-student interactions, and the use of digital learning media. Document analysis involved reviewing lesson plans (RPP), school work programs, instructional materials, assessment records, and teachers' reflective notes to corroborate findings from interviews and observations [19]–[21].

In qualitative research, the researcher functions as the primary research instrument, as data collection and interpretation are closely linked to the researcher's engagement with the field [22]. To enhance systematic data collection, supporting instruments were

developed, including interview guidelines, observation checklists, documentation matrices, and field note formats. These instruments facilitated consistency while allowing flexibility to adapt to emerging field conditions.

Data trustworthiness was ensured by applying the four criteria proposed by Lincoln and Guba: credibility, transferability, dependability, and confirmability (Lincoln & Guba, 1985). Credibility was established through data triangulation across sources and methods, as well as member checking to confirm the accuracy of participants' statements. Transferability was supported by providing rich, thick descriptions of the research context and participants. Dependability and confirmability were enhanced through an audit trail, detailed documentation of research procedures, and reflexive notes to minimize researcher bias [21].

Data analysis followed the interactive model proposed by Miles, Huberman, and Saldaña [23] which consists of three interconnected stages: (1) data reduction, involving the selection, coding, and condensation of raw data; (2) data display, in which organized data were presented in the form of narrative descriptions, matrices, and tables to facilitate interpretation; and (3) conclusion drawing and verification, where patterns, themes, and relationships were identified and continuously verified throughout the research process. Data analysis was conducted concurrently with data collection, allowing the researcher to refine focus and respond adaptively to emerging findings.

The research was conducted over a three-month period, from June to August 2025, encompassing preparatory activities, field data collection, data analysis, and report writing. Through this methodological approach, the study aims to produce a comprehensive and credible understanding of teacher management strategies in integrating technology into IPAS learning, thereby contributing empirical evidence to the fields of educational management and technology-enhanced learning in elementary education.

3 Results

3.1 Planning of Teacher Management Strategies in Integrating Technology

The findings indicate that planning constitutes a fundamental stage in teacher management strategies for integrating technology into IPAS learning at SDN Giriwinaya and SDN Sukabakti. Based on interview data, classroom observations, and document analysis, teachers demonstrated deliberate efforts to design learning activities that align technological tools with instructional objectives and student characteristics.

Interviews with IPAS teachers revealed that lesson planning was intentionally oriented toward integrating technology as a learning support rather than merely as a teaching aid. Teachers emphasized the importance of adjusting technological use to students' literacy levels and cognitive readiness. One teacher from SDN Giriwinaya stated:

"In planning IPAS lessons, I always adjust the use of technology to the students' abilities. Not all materials need to be digital; rather, technology is used to help

students more easily understand abstract concepts.” (Teacher A, interview, June 2025)

Similarly, a teacher from SDN Sukabakti explained that lesson plans were designed by considering both pedagogical goals and technological feasibility:

“We design lesson plans by considering the subject matter, teaching methods, and digital media available at the school. In principle, technology should support learning objectives, not merely follow trends.” (Teacher B, interview, June 2025)

These statements indicate that teachers adopted a reflective and selective approach in planning technology integration, aligning with the Technological Pedagogical Content Knowledge (TPACK) framework.

Observational data supported the interview findings. During classroom observations, teachers were found to have prepared learning scenarios that incorporated digital media such as instructional videos, interactive presentations, and simple online quizzes. The learning objectives were clearly communicated at the beginning of lessons, and teachers demonstrated readiness in operating digital tools. Observations also showed that teachers anticipated potential technical constraints by preparing alternative non-digital activities when internet access was unstable.

Document analysis of lesson plans (RPP), teaching schedules, and instructional materials further confirmed the systematic nature of the planning process. The reviewed RPP documents explicitly included learning objectives related to digital literacy, descriptions of technology-based learning activities, and evaluation techniques using digital assessments. This documentation demonstrates that technology integration was formally embedded in instructional planning rather than implemented spontaneously.

To synthesize the findings from interviews, observations, and documentation, Table 1 presents a summary of teacher planning strategies in integrating technology into IPAS learning.

Table 1. Teacher Planning Strategies for Technology Integration in IPAS Learning

No.	Planning Component	Technology Integration Aspect	Description
1	Lesson plan design (RPP)	TPACK-based planning	Teachers integrate content, pedagogy, and technology in lesson objectives and activities
2	Student needs analysis	Digital literacy consideration	Planning is adjusted to students' literacy levels and learning characteristics
3	Media selection	Digital learning media	Use of videos, interactive presentations, and online learning resources
4	Learning objectives	Higher-order thinking skills	Objectives emphasize critical thinking, understanding concepts, and digital literacy
5	Anticipation of constraints	Alternative learning plans	Teachers prepare non-digital backups to address technical limitations

Source: Interviews, classroom observations, and document analysis (2025)

Overall, the planning stage reflects teachers' roles as learning managers who strategically design technology-integrated instruction. Teachers' planning practices demonstrate an awareness that effective technology integration requires alignment between learning objectives, student needs, and available resources. These findings suggest that careful planning serves as a foundation for successful implementation and evaluation of technology-based IPAS learning.

3.2 Organizing of Teacher Management Strategies in Integrating Technology

The organizing stage focuses on how teachers coordinate and allocate resources, roles, and responsibilities to support the integration of technology in IPAS learning. Findings from interviews, classroom observations, and document analysis reveal that teachers at SDN Giriwinaya and SDN Sukabakti actively organized both human and technological resources to ensure the feasibility and continuity of technology-based instruction.

Interview data indicate that teachers were not working individually in organizing technology integration, but rather engaged in collaborative practices with school principals and fellow teachers. A teacher from SDN Sukabakti explained:

"The organization of technology-based learning cannot be done individually. We coordinate with the principal and other teachers, especially regarding the use of projectors and the scheduling of equipment usage." (Teacher B, interview, July 2025)

Another teacher from SDN Giriwinaya emphasized the importance of task distribution and mutual support among teachers:

"We share responsibilities and experiences with one another. If there is a teacher who is more knowledgeable about technology, they usually help other teachers, especially when preparing digital learning media." (Teacher A, interview, July 2025)

These statements suggest that organizing technology integration involves collaborative management and informal peer mentoring among teachers.

Observational data show that teachers systematically arranged classroom settings and technological tools before instruction began. Laptops, projectors, speakers, and internet connections were prepared in advance to minimize disruption during lessons. In several observed classes, teachers also assigned students specific roles, such as operating simple digital tools or assisting peers, which contributed to smoother learning activities and increased student engagement.

Document analysis of school schedules, asset inventories, and meeting notes indicates that technology-related resources were managed through coordinated planning at the school level. Documentation shows the existence of shared schedules for the use of projectors and internet access, as well as informal agreements among teachers regarding the maintenance and responsible use of digital equipment. These documents demonstrate that organizing technology integration extended beyond classroom-level decisions to broader school management practices. Table 2 summarizes the organizing strategies employed by teachers in managing technology integration for IPAS learning.

Table 2. Organizing Strategies for Technology Integration in IPAS Learning

No.	Organizing Aspect	Management Practice	Description
1	Resource allocation	Shared use of digital tools	Teachers coordinate schedules for projectors, laptops, and internet access
2	Human resources	Collaborative teaching	Teachers collaborate and share expertise in using digital media
3	Role distribution	Task delegation	Teachers and students are assigned specific roles during learning activities
4	Coordination with leadership	Principal involvement	School principals support scheduling and provision of technological facilities
5	Classroom organization	Learning environment arrangement	Classrooms are organized to support the use of digital media effectively

Source: Interviews, classroom observations, and document analysis (2025)

The organizing stage demonstrates that effective technology integration in IPAS learning requires structured coordination of resources and collaborative engagement among teachers and school leaders. Teachers function as managers who ensure that available technological tools are utilized optimally and equitably. This finding underscores the importance of organizational support and collegial collaboration in sustaining technology-based learning practices in elementary schools.

3.3 Implementation of Teacher Management Strategies in Integrating Technology

The implementation stage reflects how planned and organized strategies are translated into real classroom practices. Findings from interviews, classroom observations, and document analysis indicate that teachers at SDN Giriwinaya and SDN Sukabakti actively utilized digital media to support IPAS learning and to enhance student engagement, understanding, and digital literacy.

Interview data reveal that teachers intentionally employed technology to create interactive and student-centered learning environments. A teacher from SDN Giriwinaya explained:

“During the implementation of IPAS learning, technology is very helpful. Students are more enthusiastic when the material is presented through videos or moving images rather than only reading textbooks.” (Teacher A, interview, June 2025)

Another teacher highlighted that technology facilitated conceptual understanding, especially for abstract scientific phenomena:

“Some IPAS concepts are difficult to understand if they are explained only verbally. With videos and simple simulations, students grasp the material more quickly.” (Teacher B, interview, June 2025)

These statements indicate that teachers viewed technology as a pedagogical tool to enhance comprehension rather than as a supplementary accessory.

Classroom observations showed that teachers implemented technology in various instructional phases, including lesson introduction, core activities, and closure. During observed lessons, teachers used instructional videos, digital slides, and interactive quizzes to explain IPAS concepts. Students were actively involved in observing digital content, answering questions, and participating in group discussions based on digital materials.

Observations also revealed increased student motivation and participation. Students demonstrated curiosity, asked questions related to video content, and collaborated with peers during technology-assisted activities. However, in some sessions, technical issues such as unstable internet connectivity required teachers to adjust instruction by switching to offline digital materials.

Document analysis of teaching materials, digital worksheets, and assessment records confirmed the integration of technology in instructional delivery. Teachers prepared digital slides, curated online learning resources, and documented student learning outcomes through both digital and conventional formats. Lesson implementation reports also indicated that teachers reflected on student responses to technology-based learning activities, using these reflections to inform subsequent lessons. Table 3 presents a summary of teacher implementation strategies in integrating technology into IPAS learning.

Table 3. Implementation of Technology Integration in IPAS Learning

No.	Implementation Aspect	Technology Use	Description
1	Learning media	Videos and digital slides	Visual content used to explain IPAS concepts
2	Learning activities	Interactive instruction	Students engage in discussions and digital-based tasks
3	Student engagement	Active participation	Technology increases motivation and attention
4	Instructional flexibility	Adaptive strategies	Teachers adjust instruction when technical issues arise
5	Learning documentation	Digital learning records	Teachers document activities and outcomes digitally

Source: Interviews, classroom observations, and document analysis (2025)

The implementation findings demonstrate that technology integration in IPAS learning was conducted in a structured and pedagogically meaningful manner. Teachers acted as facilitators who guided students in using digital media to explore concepts, engage in discussions, and construct understanding collaboratively. This stage highlights the practical realization of teacher management strategies, where instructional planning and organization are translated into interactive classroom practices that support deeper learning.

3.4 Evaluation and Monitoring of Teacher Management Strategies in Integrating Technology

The evaluation and monitoring stage represents the final component of teacher management strategies in integrating technology into IPAS learning. This stage focuses on how teachers assess student learning outcomes, reflect on instructional effectiveness, and monitor the sustainability of technology use. Findings from interviews, classroom observations, and document analysis indicate that teachers at SDN Giriwinaya and SDN Sukabakti employed both formative and reflective evaluation practices supported by digital tools.

Interview data show that teachers perceived evaluation as an integral part of improving technology-integrated instruction rather than merely measuring student achievement. A teacher from SDN Sukabakti stated:

“Evaluation is not only used to assess students, but also to determine whether the digital media used has been effective or not. From there, I can improve the next lesson.” (Teacher B, interview, July 2025)

Another teacher emphasized the benefits of digital assessment tools in providing immediate feedback:

“With online quizzes or Google Forms, I can immediately see students’ results. This helps me identify which parts have not yet been understood by the students.” (Teacher A, interview, July 2025)

These statements suggest that evaluation was used as a reflective mechanism to improve both teaching strategies and learning outcomes.

Classroom observations revealed that teachers conducted ongoing evaluations during and after instruction. During lessons, teachers asked reflective questions based on digital content and monitored student responses in real time. At the end of learning sessions, teachers facilitated short reflections, either orally or through simple digital questionnaires, to gauge students’ understanding and engagement.

Observations also indicated that teachers closely monitored technical aspects, such as students’ ability to operate digital tools and the effectiveness of media used. When challenges arose such as limited internet access teachers recorded these issues for consideration in future lesson planning.

Document analysis of assessment records, digital quizzes, student portfolios, and teachers’ reflective notes confirms that evaluation practices were systematically documented. Teachers maintained records of students’ digital assignments, project-based tasks, and quiz results. Reflective notes indicated teachers’ awareness of strengths and weaknesses in technology integration, including challenges related to infrastructure and varying levels of student digital literacy. Table 4 summarizes the evaluation and monitoring strategies used by teachers in integrating technology into IPAS learning.

Table 4. Evaluation and Monitoring of Technology Integration in IPAS Learning

No.	Evaluation Aspect	Technology-Based Practice	Description
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1	Student assessment	Online quizzes, Google Forms	Real-time assessment of student understanding
2	Learning outcomes	Digital portfolios	Documentation of student work and progress
3	Teacher reflection	Reflective notes	Evaluation of media effectiveness and teaching strategies
4	Learning monitoring	Observation and feedback	Monitoring student engagement and digital skills
5	Identified challenges	Infrastructure limitations	Internet access and device availability constraints

Source: Interviews, classroom observations, and document analysis (2025)

The evaluation and monitoring stage demonstrates that teachers functioned as reflective practitioners and learning managers. Evaluation was not limited to measuring student performance but also served as a mechanism for continuous improvement of instructional strategies and technology use. The findings highlight that systematic evaluation supports informed decision-making, enabling teachers to refine planning, organization, and implementation stages in subsequent learning cycles.

Overall, the integration of digital assessment tools and reflective practices contributed to a more responsive and adaptive learning environment. These findings reinforce the notion that effective teacher management strategies require continuous monitoring and evaluation to ensure that technology integration meaningfully enhances IPAS learning and students’ digital literacy development.

4 Discussion

This study examined teacher management strategies in integrating technology into IPAS learning at SDN Giriwinaya and SDN Sukabakti through four core management functions: planning, organizing, implementation, and evaluation. The findings demonstrate that teachers play a dual role as instructional practitioners and learning managers who systematically manage resources, strategies, and reflections to enhance learning quality in elementary education.

The findings indicate that careful planning is the cornerstone of successful technology integration. Teachers designed lesson plans (RPP) that explicitly incorporated digital media, learning objectives oriented toward higher-order thinking skills, and considerations of students’ digital literacy levels. This aligns with the Technological Pedagogical Content Knowledge (TPACK) framework, which emphasizes that effective technology integration emerges from the intersection of content knowledge, pedagogical strategies, and technological competence [24].

From a management perspective, these findings support classical management theory, which posits planning as the primary function guiding subsequent managerial actions [25]. Teachers’ ability to anticipate technical constraints and prepare alternative instructional strategies reflects adaptive planning, an essential characteristic of effective educational management in dynamic digital contexts. This result extends previous studies that focused primarily on teacher readiness [7] by demonstrating that readiness must be embedded within a structured planning framework.

The organizing stage revealed that technology integration was sustained through collaborative coordination among teachers, principals, and students. Teachers managed limited technological resources by sharing equipment, coordinating schedules, and engaging in peer support. This finding corroborates organizational behavior theory, which highlights the importance of coordination and collaboration in achieving organizational goals [26].

In educational settings, organizing learning resources is critical for minimizing disruptions and maximizing instructional effectiveness. The study's findings support blau, who argue that teacher collaboration enhances adaptability in digital learning environments [27]. However, this study adds novelty by positioning organizing not merely as logistical coordination but as a strategic managerial practice that enables equitable access to technology and fosters a culture of professional collaboration in elementary schools.

The implementation findings show that teachers employed digital media to facilitate interactive, student-centered IPAS learning. Technology was used to visualize abstract concepts, stimulate discussion, and encourage active participation. These results are consistent with constructivist learning theory, which posits that learners construct knowledge through interaction and engagement with learning resources [28].

Moreover, the findings support empirical studies demonstrating that technology-enhanced instruction increases student motivation and engagement when aligned with pedagogical goals [29], [30]. Importantly, this study highlights teachers' flexibility in adapting instruction when technical issues occurred, underscoring the managerial competence required to sustain learning continuity. Thus, implementation is not merely a technical execution but a managerial enactment of prior planning and organization.

Evaluation and monitoring emerged as reflective practices aimed at improving both student learning outcomes and instructional strategies. Teachers used digital assessments, portfolios, and reflective notes to monitor student progress and the effectiveness of technology use. This aligns with the controlling function of management, which emphasizes continuous monitoring and corrective action to ensure goal attainment.

The findings resonate with Shenton's view that reflective evaluation strengthens decision-making and instructional improvement. Unlike prior studies that emphasized assessment outcomes alone, this study demonstrates that evaluation also serves as a feedback mechanism for refining planning, organizing, and implementation stages. Consequently, evaluation functions as a cyclical process that sustains continuous improvement in technology-integrated learning.

Overall, the findings support three key theoretical functions. First, descriptively, this study illustrates how teacher management strategies operate across planning, organizing, implementation, and evaluation stages in real classroom contexts. Second, explanatorily, the study explains why structured management strategies enable effective technology integration by aligning resources, pedagogy, and reflection. Third, predictively, the findings suggest that stronger teacher management capacities will lead to higher-quality IPAS learning and enhanced digital literacy among elementary students.

The novelty of this research lies in its emphasis on teachers as strategic managers of technology integration rather than mere users of digital tools. By framing technology integration as a managerial process, this study contributes to the development of educational management theory in the context of digital transformation in elementary education.

5 Conclusion

This study concludes that teacher management strategies in integrating technology into IPAS learning at SDN Giriwinaya and SDN Sukabakti are implemented through four interrelated stages: planning, organizing, implementation, and evaluation. At the planning stage, teachers design TPACK-based lesson plans that align learning objectives, digital media, and students' literacy needs. Organizing strategies involve collaborative resource management, coordination with school leadership, and peer support among teachers. During implementation, technology is used to facilitate interactive and student-centered learning, while evaluation and monitoring are conducted through digital assessments, reflective practices, and continuous observation to improve instructional effectiveness.

The findings demonstrate that structured teacher management strategies contribute to increased student engagement, improved conceptual understanding, and the development of digital literacy in elementary IPAS learning. Despite challenges related to infrastructure and internet access, teachers' managerial roles enable adaptive and sustainable technology integration. This study contributes theoretically by reinforcing the role of management functions in technology-enhanced learning and practically by providing a reference for teachers, schools, and policymakers in developing effective and context-sensitive digital learning strategies in elementary education.

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